

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

NUTRIENT MANAGEMENT

(Acre)
CODE 590

DEFINITION

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

PURPOSES

- ◆ To budget and supply nutrients for plant production.
- ◆ To properly utilize manure or other organic by-products as a plant nutrient source.
- ◆ To minimize agricultural non-point source pollution of surface and ground water resources.
- ◆ To maintain or improve the physical, chemical and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

CRITERIA

General Criteria Applicable to All Purposes

Nutrient management practices shall comply with all applicable Federal, state, and local laws and regulations.

Nutrient management practices shall be developed in accordance with policy

requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

WHO CAN APPROVE

Persons who review or approve nutrient management shall be certified through the NRCS job approval cited in the General Manual 180, Part 409. Resource Management Systems (RMS) that contain nutrient management and are part of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.

NUTRIENT BUDGET

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water. The **NM Manure Management software** (a version of the Agricultural Waste Management Field Handbook method) or equivalent paper

version will be used to calculate the nutrient budget for sites producing animal manure and organic by-products. Inorganic fertilizer recommendation budgets will be developed using New Mexico State University's fertilizer recommendation software **NMSU Fertilizer Interpretation software** (Excel spreadsheet) or other NRCS approved software.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. For new crops or varieties, industry yield recommendations may be used until documented yield information is available. The NRCS state agronomist and New Mexico State University (NMSU) shall establish yield goals and nutrient requirements for new crops as soon as possible.

PRACTICE REQUIREMENTS

The nutrient management practice specification shall list the **form, source, amount, timing and method of application** of nutrients on each field to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

Erosion, runoff, and water management controls shall be installed, to meet Section III of the FOTG, on fields that receive nutrients. Irrigated fields must have an Irrigation Water Management practice developed (Practice Code 449). Soil Sampling and Laboratory Analysis (testing) are part of the inventory process.

Agricultural waste shall not be land-applied on soils that are frequently flooded, as defined by the National

Cooperative Soil Survey, during the period when flooding is expected.

SOIL TESTING

Nutrient planning shall be based on a current soil test developed in accordance with NMSU guidance or industry practice if recognized by the NMSU. Current soil tests are those that are no older than five years. Annually cropped fields will have a soil test taken the first year of a new plan or rotation, thereafter once in five years as a minimum. Hayland, rangeland and pasture can be tested once in five years. If organic sources of fertilizers are used two or more consecutive years, annual soil testing is required.

After a baseline of two sampling periods, similar fields (rotation, soil, slope, organic nutrient application, and irrigation type) can use a composite or aggregate (combined) sample to represent the group of fields. Nutrient recommendations for each crop can be made according to the results of the composite soil test.

Soil samples shall be collected and prepared according to the NMSU Extension guidance (Guide A-114).

Soil test analyses shall be performed by laboratories that are accepted in one or more of the following programs:

- ◆ The North American Proficiency Testing Program (Soil Science Society of America), or
- ◆ Laboratories whose tests are accepted by the NMSU.

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses specified in NMSU Extension guide A-122.

These analyses will include: **pH, electrical conductivity (EC), soil organic matter**

(OM), **nitrate nitrogen** (N), phosphorus (P), **potassium** (K), **magnesium**, **calcium**, and **sodium** (SAR). Many soils and crops in NM also show a need for sulfur, zinc, manganese, and other micronutrients.

Special Testing Requirements for NM (very important):

- **Cations** (calcium (Ca^{++}), magnesium (Mg^{++}), and sodium (Na^{+}), and **Electrical Conductivity** (EC): Cations and EC will be tested using a **saturated paste method**.
- **Phosphorus** - If the pH is greater than seven, an **Olsen (Sodium Bicarbonate)** P-test will be done. At a pH of less than seven, the Bray P-test will be done.
- **Potassium** - K-test will be done using the **water extraction method**.

LOW NITRATE SOIL TESTS

If a soil test comes back from the lab with a test value for N at less than **1 ppm**, the sample shall be rerun at the lab (same sample). If the rerun of the first sample is still less than **1 ppm** then a new sample will be taken in the field, and re-tested.

PLANT TISSUE TESTING

Tissue sampling and testing, if used, shall be done in accordance with NMSU standards or recommendations. See NMSU Extension Guide A-123. Additional nutrients above the budget amounts may be added if interpretation of the tissue testing shows a need.

NUTRIENT APPLICATION RATES

Recommended nutrient application rates shall be based on NMSU recommendations (see Fertilizer Guide Extension A-128) and/or industry practice when recognized by the NMSU that consider current soil test results (see above), realistic yield

goals and management capabilities. NMSU Fertilizer Interpretation software (Excel spreadsheet) or other NRCS approved software may be used to generate a nutrient budget for a given crop.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- ◆ **Nitrogen Application** - Planned nitrogen (N) application rates shall match the recommended rates, except when manure or other organic by-products are a source of nutrients. When manure or other organic by-products are a source of nutrients, see "Additional Criteria" below.
- ◆ **Phosphorus Application** - Planned phosphorus (P_2O_5) application rates shall match the recommended rates, except when manure or other organic by-products are a source of nutrients. When manure or other organic by-products are a source of nutrients, see "Additional Criteria" below.
- ◆ **Potassium Application** - Excess potassium shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages. When forage quality is an issue associated with excess potassium application, state standards shall be used to set forage quality guidelines.
- ◆ **Other Plant Nutrients** - The planned rates of application of other nutrients shall be consistent with NMSU guidance or industry practice if recognized by the NMSU.
- ◆ **Starter Fertilizers** - Starter fertilizers containing nitrogen, phosphorus, potassium, and/or micronutrients may be applied in accordance with NMSU recommendations or industry practice

if recognized by NMSU. When starter fertilizers are used, they shall be included in the nutrient budget.

- ◆ **Soil amendments** can be applied, as needed, to adjust soil pH to the specific range of the crop for optimum availability and utilization of nutrients. Most conditions will not require a pH change. NM soils range from pH 6 to 8.5. Many soils have large amounts of free lime which prevent pH adjustment with amendments such as sulfur.

NUTRIENT APPLICATION TIMING

Timing and method of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, and field accessibility.

NUTRIENT APPLICATION METHODS

Nutrient applications associated with irrigation systems shall be applied in accordance with the requirements of the Irrigation Water Management practice (Practice Code 449). Fertigation will not exceed the water holding capacity of the soil.

Additional Criteria Applicable to Manure or Other Organic By-Products Applied as a Plant Nutrient Source.

NUTRIENT VALUES

Nutrient values of manure and other organic by-products shall be determined prior to land application based on laboratory analysis, acceptable “book values” recognized by the NRCS and/or the NMSU, or historic records for the operation (two or three years of no operational change), if they accurately estimate the nutrient content of the material.

Manure and Other Organic By Products are any organic material applied to land as a source of plant nutrients (e.g. food processing waste). Book values recognized by NRCS may be found in the Agricultural Waste Management Field Handbook (AWMFH), Chapter 4 - Agricultural Waste Characteristics. Acceptable values for NM can be found in the NM Nutrient Management Specification. Heavy metals in biosolids have additional criteria.

NUTRIENT APPLICATION RATES

The application rate (in/hr) for material applied through irrigation shall not exceed the soil intake/infiltration rate. The total application of water shall not exceed the water holding capacity of the soil. See the Irrigation Guide in the NM Field Office Technical Guide (FOTG, Sec I) for local soil water holding capacities and soil intake rates. Application rates must be adjusted to match the soil intake rate.

The planned rates of nitrogen and phosphorus application recorded in the specification shall be determined based on the following guidance:

NITROGEN APPLICATION –

Normal N test - When the application rate is based on N (P index < 27) and the preplant/preapplication soil nitrate reading is less than 30 ppm, the **normal agronomic rates of application will be used** (as explained under Nutrient Application Rates).

High N test - When the soil N test is between 30 -200 ppm nitrate, **additional testing will be done** to determine when more manure can be added. Additional testing will be done 25% of the way into the growth period of the crop (120 day corn would be tested 30 days after planting). If the preapplication (crop

growing) soil test is less than 80 ppm, a maximum rate of 30 lbs/ac of N can be applied.

Excessive N test – When the soil N test is greater than 200 ppm nitrate, **no more manure can be applied** until the level drops below 80 ppm. Additional testing will be done 25% of the way into the growth period of the crop (120 day corn would be tested 30 days after planting). If the preapplication (crop growing) soil test is less than 80 ppm, a maximum rate of 30 lbs/ac of N can be applied.

P index > 27 - When the practice is being implemented on a phosphorus standard (when the Phosphorus Index is High, Very High, or Excessive), manure or other organic by-products shall be applied at rates consistent with the phosphorus standard. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

N Applied to Legumes - Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass. See NM Nutrient Management Specification and the NMSU Fertilizer Recommendation spreadsheet.

PHOSPHORUS APPLICATION

When manure or other organic by-products are used, the planned rates of phosphorus application will use the NM Phosphorus Index as follows:

- ◆ **Phosphorus Index (PI) Rating.** On Very Low, Low or Medium risk sites, application rates will be based on **nitrogen** crop need. On High and Very High risk sites, application rates will be based on **phosphorus** crop need. On Excessive risk sites, **no phosphorus application is allowed.**

On High risk sites, the application rate will be based on **1.5 times the crop removal rate.** The PI for NM is found in Agronomy Technical Note 41, and is available as a MS-Excel spread sheet found on NRCS's NM website.

A single application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for the crop rotation or multiple years in the crop sequence. This can only be done when the PI is Very-Low, Low, or Medium. When such applications are made, the application rate shall:

- ◆ Not **exceed** the recommended nitrogen application rate during the year of application, or
- ◆ Not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.
- ◆ Not be made on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, and management activities are used to reduce the vulnerability. Leaching and runoff practices must be included in the resource management plan.

FIELD RISK ASSESSMENT

When animal manures or other organic by-products are applied, a field-specific assessment of the potential for phosphorus transport from the field shall be completed. This assessment will be done using the **NM Phosphorus Index (PI)**. In such cases, plans shall include:

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- ◆ a record of the PI rating for each field or sub-field, and
- ◆ Information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site. Practices will be listed in the Comment section on the worksheet.

When such assessments are done the results of the assessment and recommendations shall be discussed with the client as the practice is planned. The client will initial the review on the PI worksheet.

HEAVY METALS MONITORING

When biosolids are applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503.

Where municipal wastewater and solids (biosolids) are applied to agricultural lands as a nutrient source, the single application (annual limit) or lifetime limits of heavy metals shall not be exceeded. The concentration of salts shall not exceed the level that will impair seed germination or plant growth.

Maximum Annual and Lifetime Heavy Metal Additions to the Soils ¹		
Metal (name/symbol)	Annual Limit (lbs/ac/yr)	Lifetime Limit (lbs/ac)
Arsenic (As)	2.2	46.0
Cadmium (Cd)	2.3	33.0
Copper (Cu)	84.0	1500.0
Lead (Pb)	17.0	336.0
Mercury (Hg)	0.95	19.0
Nickel (Ni)	24.0	19.0

Selenium (Se)	5.6	112.0
Zinc (Zn)	157.0	3136.0

¹From the Code of Federal Regulations, Title 40, Vol 3, Part 503, Sec. 13, July 1, 1999

BIOSOLIDS APPLICATIONS

Biosolids shall not be applied to land that is closer than 100 feet to any water course.

Biosolids shall not be applied to land that is flooded, frozen or snow-covered.

Animal shall not be allowed to graze on the land for 30 days after the application of biosolids.

Food crops with harvested parts that touch applied biosolids and are totally above the soil surface, shall not be harvested for 14 months after the application. Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of biosolids, when the application remains on the land surface for four months or longer prior to incorporation into the soil. Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of biosolids when the application remains on the land surface for less than four months.

Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources

In areas with an identified or designated nutrient-related water quality impairment (such as the 303(d) list of impaired stream reaches), an assessment shall be completed of the potential for nitrogen and/or phosphorus transport from the field. The Leaching Index (LI) and/or Phosphorus Index (PI), or other recognized assessment tools, may be used to make these assessments. The results of these assessments and recommendations shall be

discussed with the client and included in the practice planning.

Nutrient Management practices developed to minimize agricultural nonpoint source pollution of surface or ground water resources shall include practices and/or management activities that can reduce the risk of nitrogen or phosphorus movement from the field.

Additional Criteria to Improve the Physical, Chemical, and Biological Condition of the Soil.

Nutrients shall be applied in such a manner as not to degrade the soil's structure, chemical properties, or biological condition. Use of nutrient sources with high salt content relative to the nutrient value will be minimized to prevent damage to plants. Salt levels will be monitored by soils testing to see that they do not exceed the EC rate for the crop to be grown. See Table 4 in the NM Irrigation Guide in Sec. 1 of the FOTG for the maximum allowable salt levels by crop.

Nutrients shall not be applied to flooded or saturated soils by ground equipment when the potential for soil compaction and creation of ruts is high.

Additional Criteria for Subsurface Drip Irrigation

If nutrients are added to subsurface drip irrigation systems (SDI), a jar test must be done to determine if any of the material being added to the system will cause solids to precipitate out causing the system to plug and fail. The jar test is simply a mixture of the fertilizers (at the field concentration) applied to the water and left to stand to see if any of material settles out. See Agronomy Tech Note 71.

CONSIDERATIONS

During the planning process, consider the relationship between nitrogen and phosphorus transport and water quality impairment. Consider the potential for nitrogen leaching into shallow ground water and potential health impacts. Consider the potential for phosphorus accumulation in the soil, the increased potential for phosphorus transport in soluble form, and the types of water quality impairment that could result from phosphorus movement into surface water bodies.

Consider the intent of this practice to prevent the nutrients (nitrogen and phosphorus) supplied for production purposes from contributing to water quality impairment.

Consider additional practices such as Conservation Cover (327), Grassed Waterway (412), Contour Buffer Strips (332), Filter Strip (393), Irrigation Water Management (449), Riparian Forest Buffer (391A), Conservation Crop Rotation (328), Cover and Green Manure (340), and Residue Management (329A, 329B, or 329C, and 344) to improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and to protect or improve water quality.

When applicable, plans shall include other practices or management activities as determined by specific regulation, program requirements, or client goals.

Consider induced deficiencies of nutrients due to excessive levels of other nutrients.

Consider cover crops whenever possible to utilize and recycle residual nitrogen.

Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters,

or into the atmosphere. Suggestions include:

- ◆ split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- ◆ avoid winter nutrient application for spring seeded crops,
- ◆ avoid winter plow out of alfalfa to release nitrate when plants can use it in the spring,
- ◆ band apply phosphorus near the seed row,
- ◆ use precision agricultural techniques to apply nutrient materials uniformly
- ◆ incorporation of applied manure or organic by-products immediately
- ◆ Delay field application of animal manures or other organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.
- ◆ Ammonia based N fertilizers should be incorporated the same day applied.

Consider using only perennial crops such as alfalfa, tall wheatgrass, tall fescue, Bermuda grass, or perennial ryegrass to utilize organic fertilizers such as manure.

Consider minimum application setback distances from environmentally sensitive areas, such as sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas. See NRCS Practice standard 633 for guidance.

Consider the potential problems from odors associated with the land application of animal manures, especially when applied near or upwind of residences.

Consider nitrogen volatilization losses associated with the land application of animal manures. Volatilization losses can

become significant, if manure is not immediately incorporated into the soil after application.

Consider using soil test information no older than one year.

Consider annual reviews to determine if changes in the nutrient budget are desirable (or needed) for the next planned crop. If livestock numbers change up or down 20%, or land area increases or decreases by 20%, or the crop rotation changes a review of the nutrient budget is needed.

On sites on which there are special environmental concerns, consider other sampling techniques. (For example: Soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), or soil surface sampling for phosphorus accumulation or pH changes.)

Consider ways to modify the chemistry of animal manure, including modification of the animal's diet to reduce the manure nutrient content, to enhance the client's ability to manage manure effectively.

For rapidly growing crops, apply waste in a manner that should cover no more than 25% of the leaf surface with solids.

To prevent leaf burn for some crops, apply liquids according to local climatic conditions or the NRCS irrigation guide. Application rate should vary according to the salt content (electrical conductivity for the liquid and the salt tolerance of the crop). See Table 4 in the Irrigation Water Quality section of the Irrigation Guide in Section I of the FOTG.

PLANS AND SPECIFICATIONS

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals

and to prevent or minimize water quality impairment. See **New Mexico Nutrient Management Specification 590** for required components.

OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. **Operation and maintenance will address the following:**

- ◆ Periodic specification review to determine if adjustments or modifications to the practice are needed. **As a minimum**, the specification will be reviewed and revised with each soil test cycle.
- ◆ Protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- ◆ Calibration of application equipment to ensure uniform distribution of material at planned rates.
- ◆ Documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.

Maintaining records to document practice implementation. As applicable, records include:

- ◆ soil test results and recommendations for nutrient application,
- ◆ quantities, analyses and sources of nutrients applied,
- ◆ dates and method of nutrient applications,
- ◆ crops planted, planting and harvest dates, yields, and crop residues removed,

- ◆ results of water, plant, and organic by-product analyses, and
- ◆ Dates of review and person performing the review, and recommendations that resulted from the review.

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state, or local ordinances, or program or contract requirements.

Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.

The disposal of material generated by the cleaning nutrient application equipment should be accomplished properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and leaching.

The disposal or recycling of nutrient containers should be done according to state and local guidelines or regulations.

REFERENCES

Extension publications mentioned above are available on the NMSU website,

http://www.cahe.nmsu.edu/pubs/_a/

The Animal Waste Management Field Handbook is available in most NRCS County Field Offices. It can also be accessed from the NRCS National website,

<http://www.ncg.nrcs.usda.gov/awmfh.html>

NM Manure Management software, NMSU Fertilizer Interpretation software, Phosphorus Assessment Tool, and other technical information is available on the NM NRCS website,

<http://www.nm.nrcs.usda.gov/technical/tech-notes/agro/ag57.doc>

The Code of Federal Regulations can be accessed from the website,

<http://www.access.gpo.gov/nara/cfr/index.html>. State regulations may be accessed from

the New Mexico Environment Department website, <http://www.nmenv.state.nm.us>.